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CANADIAN PATENT

TRANSPARENT AND REFLECTIVE ARTICLES

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No. OF CLAIMS 4

This invention relates to new and useful transparent and reflective coverings for glass surfaces, such as a window, which effectively reduces the amount of glare and heat transmitted by the glass without distorting images viewed through the window. They are especially suitable to reduce the amount of heat from the sun's rays, i.e., the infra-red and ultra-violet portions that is transmitted to buildings that are air conditioned. It is possible to prepare transparent glass windowpanes which reflect at least 50 percent of these rays. Where air-conditioners are used in conjunction with windowpanes of this type, a substantial reduction in the amount of cooling required of the air-conditioning system is effected.

The use of these coverings also makes possible a substantial reduction in the amount of sun glare through a window and of the adverse effects caused by ultra-violet rays, such as the fading of fabrics, etc. In addition to being highly reflective and transparent, the coverings of this invention have good durability and windows covered with them may be maintained in the normal fashion. Another advantage to covering windows, in accordance with this invention, is the degree of shatterproofing given the window by the covering.

It is possible to accomplish the above objectives to a limited degree by the use of factory tinted glass or thermopane windows, but both of these techniques are permanent and expensive and cannot be used with conventional windows. The coverings of this invention make possible an improvement in existing installations of conventional windows that is superior in many respects to these more expensive types of installations. They are also either more efficient or practical than known shading techniques.

Various coatings have also been applied to glass to reduce glare or heat transmission, but they have had limited commercial success due to one or more disadvantages, such as the difficulty in applying the materials to glass. Also, in many instances they have rendered the window opaque or distort images viewed through the window.

The above objectives and improvements are accomplished by placing a flexible, transparent, metallized sheet material in intimate and uniform contact with the inside surface of the glass. The sheet material is adhered to the glass surface by means of a water-activated adhesive applied to the metallized side of a transparent and flexible polymer film (0.5 to 2 mil thick). The thin metallized surface is prepared by vapor depositing a thin layer of metal on the surface of the film such that the transmission of the visible spectrum through the sheet material is reduced less than 50 per cent (preferably 30 per cent) and may be reduced as little as 10 per cent.

Figure 1 of the drawing is a cross-sectional illustration the construction of a windowpane prepared in accordance with this invention.

Figure 2 illustrates a cross-sectional view of a preferred embodiment of the covering material containing a colored, light-stable substance. The colored substance is incorporated in the covering by applying an elastomeric protective coating over the metallized surface of the film surface in order that the colored substance applied in a vehicle may be permanently and uniformly affixed to the protective coating. The water-activated adhesive is then applied to the colored layer.

More specifically, a covering such as is illustrated in Figure 2 was prepared as follows:

Polyethylene terephthalate film (1 mil) was metallized by vapor deposition of aluminum on its surface until the film's ability to transmit the visible range of the spectrum had been reduced 20 per cent. In other words, the film retained 80 per cent of its original ability to transmit the visible portion of the sun's spectrum. The metal surface of the film was coated by squeeze roll with a 5 per cent solution of butadiene: acrylonitrile elastomer ("Hycar 1011," a product of B. F. Goodrich Chemical Co.) in a 50:50 mixture of methyl ethyl ketone and toluene, dried at 150°F. and exposed to an ultra-violet light source (2537°A) which effected a chemical bond between the elastomer and the film. A transparent, light-stable pigment, Holland Flush Permanent Green "FS-865" (one part) dispersed in a polybutyl methacrylate-nitro cellulose vehicle, DuPont clear lacquer 1234, (150 parts) and toluene (50 Parts) was applied to the elastomer's surface (1.25 mg/sq.cm.) and dried at 150°F.

An adhesive composed of casein (100 parts), ammonium hydroxide (25 parts), water (510 parts) and containing a small amount of fungicide was applied by squeeze roll coating to the pigmented surface and dried at 150°F.

This sheet material was applied and uniformly adhered to a glass surface with the water-activated adhesive by immersion of the sheet material in an aqueous ammonia solution having a pH of 11 and placing the adhesive coated side of the sheet material in contact with the glass surface which had been wetted with water. Excess water was removed from behind the sheet material by the use of a squeegee which also positioned the sheet material on the glass surface. Upon complete drying of the

adhesive layer, the sheet material is firmly affixed to the window surface and may be washed and maintained in the usual manner.

The resulting green tinted windowpane was observed to reflect 77.5 per cent of the ultra-violet (3400-4000Å) and 76.5 per cent of the infra-red (7500-29,000Å) portions of the sun's rays hitting the outside surface of the windowpane. It was also observed that there was a substantial reduction in glare and that images viewed through the windowpane were undistorted.

Examples of other sheet materials of demonstrated effectiveness as coverings for glass in accordance with the teachings of this invention are cellulose-acetate and polyethylene terephthalate films lightly vapor coated with aluminum in which the aluminized side was coated with a casein water-activable adhesive and polyethylene terephthalate film vapor coated with aluminum in which the aluminized surface had been uniformly bonded to a butadiene-acrylonitrile elastomer covered by Holland Flush Phthalocyanin Blue dispersed in a vehicle and in which the coloring layer was coated with polyvinyl alcohol as the water-activable adhesive.

Polyethylene terephthalate film is especially useful in this invention and is preferred because of its clarity and dimensional stability, particularly in regard to changes in humidity and temperature, toughness and ability to accept and adhere to a metal vapor coat. Other suitable polymers which may be employed as backings are rigid (unplasticized) polyvinyl chloride, polyethylene, polyproplyene, cellulose acetate, cellulose acetate-butyrate, and polystyrene. Of course, the stability of these films may be improved, if necessary or desirable, by known techniques, such as by the use of ultraviolet ray absorbers.

These films are vapor coated in the conventional manner, except that the degree of metal deposition is measured and controlled by the reduction in light transmission of the visible spectrum, such that 50 to 90 per cent of the visible portion of the spectrum is still transmitted. Besides aluminum, other suitable metals for vapor deposition, include brass, tin, silver, and gold.

From an aesthetic standpoint, it has been found useful to employ green, blue-green or gray light-stable pigments in the construction of the tinted sheet materials.

We Claim:

1. A heat-reflective, rigid, transparent, windowpane comprising a glass panel forming the outermost surface of the windowpane uniformly adhered to a flexible sheet material serving as the innermost surface of the windowpane by means of a water-activated adhesive, said sheet material having a metal deposit on the side forming an interface with the glass panel, whereby at least 50 per cent of the sun's rays in the infra-red and ultra-violet regions are reflected by the metal deposit and the ability to see through the windowpane from the side looking toward the area of greatest light intensity is only slightly impaired.

2. A heat-reflective, rigid, transparent windowpane comprising a glass panel forming the outermost surface of the windowpane uniformly adhered to a flexible, transparent, tinted sheet material with a water-activated adhesive, said sheet material comprising a backing of an optically clear flexible polymer film having a thickness of 0.5 to 2 mils and one metallized surface, said metal surface reducing the transmittancy of the backing to the visible portion of the spectrum by 10 to 50 per cent, as compared to the ability of the optically-clear polymer film to transmit the visible portion of the spectrum prior to metallization of its surface, said metallized surface uniformly adhered to a uniform protective coating of an elastomer, said protective coating uniformly adhered to a layer of a colored, light-stable substance dispersed in a vehicle, wherein at least 50 per cent of the sun's rays in the infra-red and ultra-violet regions are reflected by the windowpane.

3. A flexible, transparent, tinted sheet material adapted for use as a covering for glass surfaces to reduce glare and heat transmission of windowpanes comprising a backing of an optically-clear flexible polymer film having a thickness of 0.5 to 2 mils and one metallized surface, said metal surface reducing the transmittancy of the backing to the visible portion of the spectrum by 10 to 50 per cent, as compared to the ability of the optically-clear polymer film to transmit the visible portion of the spectrum prior to metallization of its surface, said metallized surface uniformly adhered to a uniform protective coating of an elastomer, said protective coating uniformly adhered to a layer of a colored, light-stable substance dispersed in a vehicle, and said vehicle uniformly adhered to a water-activated adhesive.

4. A flexible, transparent, tinted sheet material adapted for use as a covering for glass surfaces to reduce glare and heat transmission of windowpanes comprising a backing of an optically-clear flexible polyethylene terephthalate film having a thickness of 0.5 to 2 mils and one aluminized surface, said aluminum surface reducing the transmittancy of the backing to the visible portion of the spectrum by 10 to 30 per cent, as compared to the ability of the polyethylene terephthalate film to transmit the visible portion of the spectrum prior to aluminization of its surface, said aluminized surface uniformly adhered to a uniform protective coating of an elastomer, said protective coating uniformly adhered to a layer of a colored, light-stable substance dispersed in a vehicle, said vehicle uniformly adhered to a casein water-activated adhesive.

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TRANSPARENT AND REFLECTIVE ARTICLES

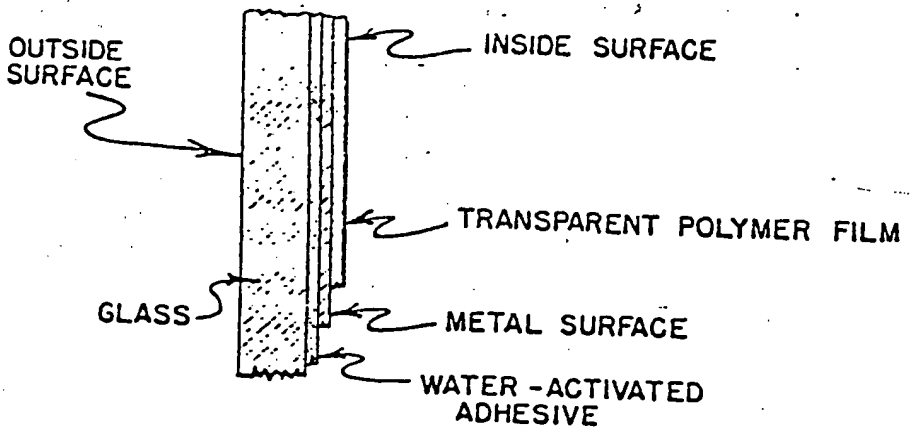

FIG. 1

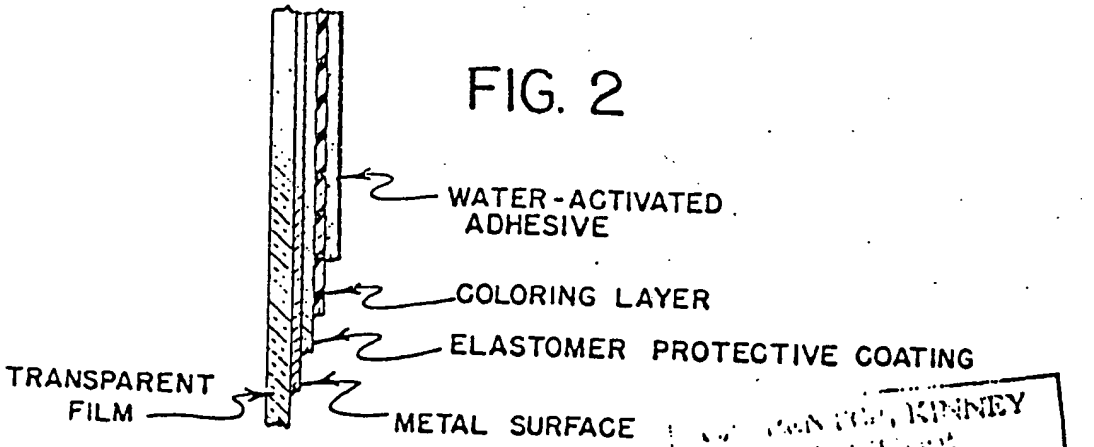

FIG. 2